[redacted] STAT

April 1, 1970

Washington, D.C.

Dear Ray:

Here is the request for service for the color gamut generation. I'm sorry it was delayed, but I was expecting someone from your facility to be here last Friday and I was going to give it to him to take. Unfortunately, he got fouled up due to the airline situation.

During my last visit, [redacted] was asking me some questions about the need for the number of samples of material required for the generation of the color gamut. Although you have probably covered this with him, we have written a little memo which covers this, and have included it for your use. STAT

If I can be of any help, please give me a call.

Sincerely,

[redacted] STAT

Scientific & Engineering App.

WWM/mls

Encl:

Color Gamut

Some question has existed as to the need of generating the large number of color patches for the color gamut program. The patches in question were to be used in generating the color gamut grid overlay plot to the C.I.E. chromaticity diagram.

This question is simply answered by the non-linear relationship existing between equivalent neutral densities (END's) of all subtractive color processes and the CIE chromaticity diagram. As a result a series of 2,700 color patches in .1 density increments were estimated as the number needed to generate a full range of colors on the material. Evans, Hanson, and Brewer, in their book, Principles of Color Photography, page 510, indicate the necessary color combinations that are required to generate a color gamut. Figure 1 shows an illustration of a CIE chromaticity diagram with the END grid overlay. The grid shown in figure 1 shows where the various combinations of the three dye layers of a color film could plot. For most color processes the maximum dye concentration equals a density of 3.0, as shown.

The gamut or range of color a film will produce is enclosed within the boundaries of the END grid. The radial lines terminating at C, M, and Y represent the chromaticity plots of the three individual dye layers. The outer boundary which is roughly triangular, where these three points lie, represents the various mixtures of the three dyes taken two at a time with the maximum amounts of one of the three dye layers. The gridwork within this boundary represents the chromaticities obtained by mixture of various lesser amounts of the three dyes taken two at a time.

The point where any of these dye combinations will fall cannot be calculated from the generation of a few representative color patches. This is due to the nonlinear nature of subtractive color processes. As a result the samples of the entire range of colors a film is capable of producing need to be generated. The patches are then measured, colorimetrically and densitometrically, plotted on the CIE chromaticity diagram, and lines of best fit used to generate the grid.

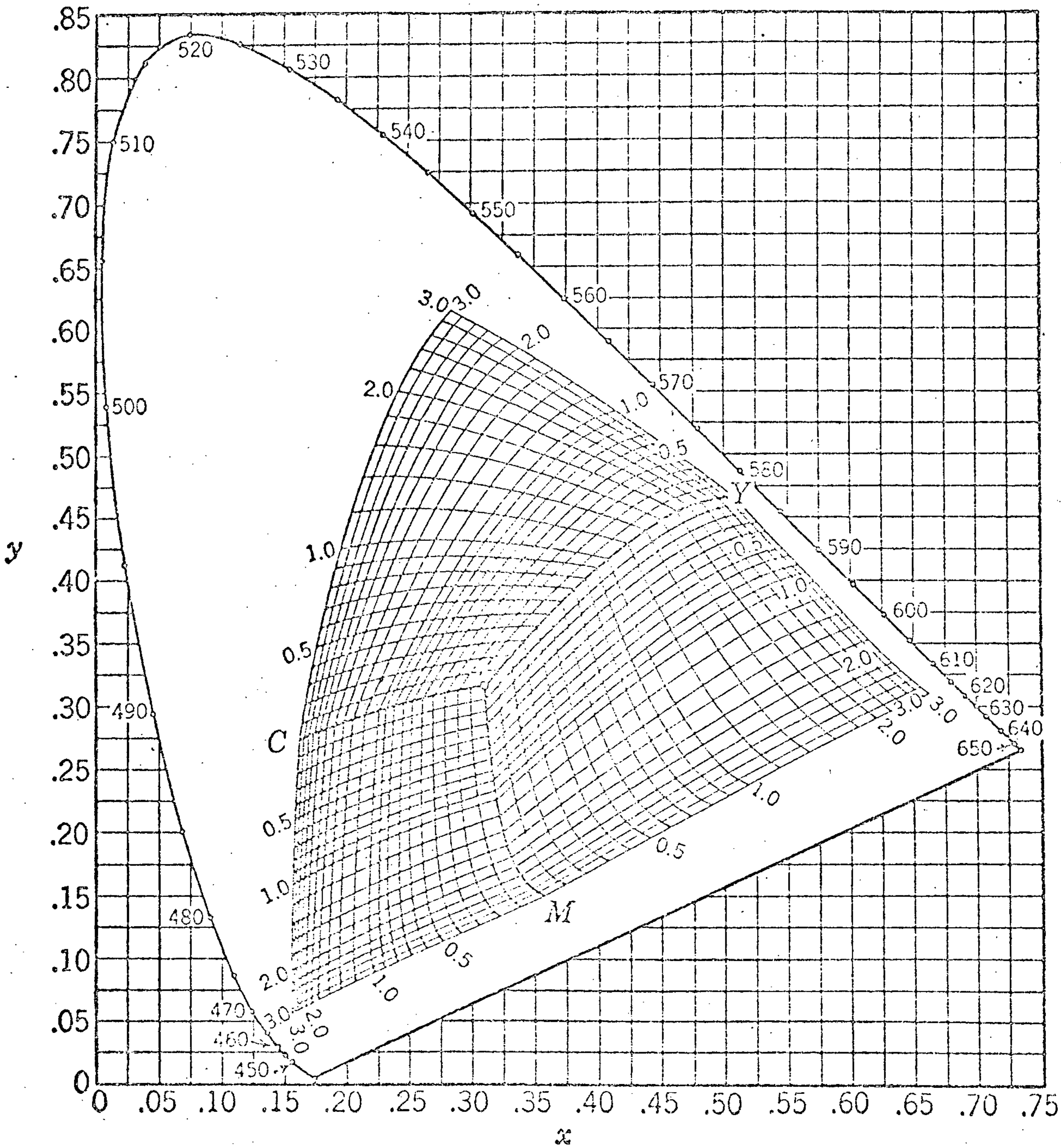

Figure 1. Chromaticity diagram for a dye set with CIE Illuminant C. The numbers indicate the equivalent neutral densities of the dye components.

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If a density range of 0 to 3.0 is assumed for each dye in density increments of .1, approximately 2,700 sample patches are required. Thirty density levels taken two at a time equals 90 sample for one portion of the diagram. There are three sections of the END grid for the cyan, magenta, and yellow primary dye layers. The total is then calculated by: $30^2 \times 3 = 2,700$ samples.